IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appellant:	John W. Jacobs		
Assignee:	NEC Electronics America, Inc.		
Title:	TUNGSTEN PLUG CORROSION PREVENTION METHOD USING WATER		
Application No.:	10/602,291	Filing Date:	June 24, 2003
Examiner:	Lynne Anne Gurley	Group Art Unit:	2812
Attorney Docket No.:	NEC0252US	Confirmation No.:	1241

Austin, Texas
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Alexandria, VA 22313-1450

APPEAL BRIEF UNDER 37 C.F.R. 1.191

This brief is submitted in support of the appeal filed July 17, 2006 by the Appellant to the Board of Patent Appeals and Interferences from the Examiner's final rejection of claims 1-9 and 27-37. The Appellant notes that the appeal filed July 17, 2006 was received by the USPTO on July 21, 2006, thereby giving the Appellant a period for filing set to expire on September 21, 2006. Filed herewith is a Petition for Extension of Time requesting a one-month extension, thereby giving the undersigned a period until October 23, 2006, in which to respond since October 21, 2006, falls on a Saturday.

Please charge deposit account No. 502306 for the fee of $500.00 associated with this appeal brief. Please charge this deposit account for any additional sums which may be required to be paid as part of this appeal.

REAL PARTY IN INTEREST

The real party in interest on this appeal is NEC Electronics America, Inc.

RELATED APPEALS AND INTERFERENCES

There are no appeals or interferences related to this application.

STATUS OF CLAIMS

The final office action dated March 17, 2006 rejected all pending claims. Claims 1, 5-9, 32, and 36-37 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 6,358,329 issued to Seiji Muranaka et al. ("Muranaka"). Claims 2-4, 27-31, and 33-35 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Muranaka in view of Wang et al., U.S. Patent No. 6,277,742 (Wang). All pending claims stand rejected under 35 U.S.C. § 103 as being unpatentable over U.S. Patent No. 5,476,816 issued to Karl E. Mautz ("Mautz") in view of U.S. Patent 6,410,417 issued to Nien-Yu Tsai et al. ("Tsai") and further in view of page two, paragraph nine, through page 3, paragraph 11 of the instant application. Claims 1, 27, 32 are being appealed.

STATUS OF AMENDMENTS

No amendments were filed subsequent to the final rejection of September 7, 2005.

SUMMARY OF CLAIMED SUBJECT MATTER

The invention is as set forth in the claims. To summarize the invention without intending to limit or otherwise affect the scope of the claims, the invention as set forth by independent claim 1 relates to a method. A tungsten plug 30 is formed in a dielectric layer. See, for example, paragraph [0030] and Fig. 7. Thereafter, an interconnect line 32 is formed after formation of tungsten plug 30. The tungsten plug 30 is electrically connected to conductive interconnect line 32. See, for example, paragraph [0030] and Fig. 7. Formation of connective line 32 may result in unwanted polymer residue. The polymer residue may be removed by a step of exposing the IC of Fig. 7 to a cleaning solution.

However, before the polymer residue removal step, interconnect line 32 is contacted with water for a period of time less than 120 minutes. See, for example, paragraph [0031] and Fig. 7.

The invention as set forth in independent claim 27 relates to a method. A tungsten plug 30 is formed in a dielectric layer. See, for example, paragraph [0030] and Fig. 7. Thereafter, an interconnect line 32 is formed after formation of tungsten plug 30. The tungsten plug 30 is electrically connected to conductive interconnect line 32. See, for example, paragraph [0030] and Fig. 7. Formation of connective line 32 may result in unwanted polymer residue. The polymer residue may be removed by a step of exposing the IC of Fig. 7 to a cleaning solution. However, before the polymer residue removal step, interconnect line 32 is contacted with water for a period of time less than 120 minutes. See, for example, paragraph [0031] and Fig. 7. The water that contacts conductive line 32 may have a pH that is slightly higher or lower than neutral. See, for example, paragraph [0033] and Fig. 7.

The invention as set forth by independent claim 32 relates to a method. A tungsten plug 30 is formed in a dielectric layer. See, for example, paragraph [0030] and Fig. 7. Thereafter, an interconnect line 32 is formed after formation of tungsten plug 30. The tungsten plug 30 is electrically connected to conductive interconnect line 32. See, for example, paragraph [0030] and Fig. 7. Formation of conductive line 32 may result in unwanted polymer residue on the electrically conductive interconnect line. See, for example, paragraphs [0010] and [0031] in addition to Fig. 7. The polymer residue may be removed by a step of exposing the IC of Fig. 7 to a cleaning solution. However, before the polymer residue removal step, interconnect line 32 is contacted with water for a period of time less than 120 minutes. See, for example, paragraph [0031] and Fig. 7.

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

I. The rejection of independent claims 1 and 32 under 35 U.S.C § 102(b) as being unpatentable over Muranaka.

II. The rejection of independent claim 27 under 35 U.S.C § 103(a) as being unpatentable over Muranaka and Wang.

III. The rejection of independent claims 1, 27, and 32 under 35 U.S.C § 103(a) as being unpatentable over Mautz in view of Tsai and further in view of page two, paragraph nine, through page 3, paragraph 11 of the instant application.

ARGUMENT

35 U.S.C. § 102(b) Rejection

Claims 1 and 32 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Muranaka. The Examiner asserts that Figs. 1- 5 and 4:65 – 5:15 teach all the limitations of these claims. Appellant believes claims 1 and 32 are distinguishable over the cited sections of Muranaka as more fully described below.

Independent claim 1 recites:

> A method comprising:
>
> forming a tungsten plug in a dielectric layer;
>
> forming an electrically conductive interconnect line on the dielectric layer after formation of the tungsten plug, wherein the tungsten plug is electrically connected to the electrically conductive interconnect line;
>
> contacting the electrically conductive interconnect line with liquid water after formation of the electrically conductive interconnect line;
>
> contacting the electrically conductive interconnect line with a solution to remove residual polymer after the electrically conductive interconnect line is contacted with the liquid water;

wherein the electrically conductive interconnect line is contacted with the liquid water for less than 120 minutes.

Claim 1 requires contacting the electrically conductive interconnect line with a solution to remove residual polymer **after** the electrically conductive interconnect line is contacted with the liquid water. This feature is not taught or fairly suggested, either alone or in combination with the other limitations of claim 1, in the cited sections of Muranaka.

In general Muranaka relates to a method for removing resist residue. Muranaka indicates there are five embodiments of their invention. Muranaka's first embodiment for removing resist residue requires (1) a removal fluid processing step, (2) a rinsing step, (3) a draining step, (4) a water-washing step, and (5) a spin-drying step. Steps (1) – (5) are performed in order. See Muranaka 3:22-27. Importantly, Muranaka does not indicate that any of steps (2) through (5) recite contacting the electrically conductive interconnect line with a solution to remove residual polymer. Step (1) of the first embodiment might be seen as teaching claim 1's act of contacting the electrically conductive interconnect line with a solution to remove residual polymer. However, Muranaka's first embodiment fails to teach or fairly suggest that step (1) occurs **after** the electrically conductive interconnect line is contacted with the liquid water. Rather, Muranaka specifically states that the removal fluid processing step (1) is performed **before** water-washing step (4). For these reasons, the first embodiment of Muranaka fails to teach or fairly suggest claim 1.

Muranaka's second embodiment is described in 4:10-22. Muranaka's second embodiment is employed in an apparatus slightly different than the apparatus in which the Muranaka's first embodiment is employed. Muranaka states, "The resist residue removal step is identical with that in the first embodiment, and hence its explanation is omitted." Muranaka 4:21-22. Appellant reads Muranaka's second embodiment as performing the same steps set forth in the first embodiment and in the same order, but in a different apparatus. For these reasons and the reasons made above with respect to Muranaka's first embodiment, the second embodiment of Muranaka fails to teach or fairly suggest claim 1.

Muranaka's third embodiment is described in column 4:24-64. This embodiment is carried out in sequence of (1) a removal fluid processing step, (2) a washing step, and (3) a drying step. Muranaka 4:45-47 Muranaka does not indicate steps (2) and (3) of the third embodiment recite contacting the electrically conductive interconnect line with a solution to remove residual polymer. Presuming step (1) of the second embodiment is the same as claim 1's requirement of contacting the electrically conductive interconnect line with a solution to remove residual polymer, the third embodiment of Muranaka fails to teach or fairly suggest that step (1) occurs **after** the electrically conductive interconnect line is contacted with the liquid water. Rather, the removal fluid processing step (1) of Muranaka's third embodiment is performed **before** their washing step (2). Even if the washing step (2) of the third embodiment employs water, the first embodiment of Muranaka fails to teach or fairly suggest claim 1.

The first three embodiments of Muranaka described above fail to teach or fairly suggest claim 1. As noted above, Muranaka describes fourth and fifth embodiments. The Final Office Action asserts that Muranaka's fourth embodiment set forth in Figs. 1- 5 and 4:65 – 5:15 discloses all the limitations of independent claim 1. Appellant notes that a claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. Importantly, the elements must be arranged as required by the claim. See MPEP 2131.

Muranaka's fourth embodiment is described in 4:65 - 5:17. Specifically, the fourth embodiment is directed to a rinsing method and/or a washing method for removing resist residue and is characterized in that a fluid used for rinsing or washing (e.g., ultrapure water, a fluid specifically designed for rinsing purpose, or a combination thereof) is maintained at a temperature of 20 degrees C or less. Muranaka then states:

> In order to improve the efficiency of substitution of the residual removal fluid during the rinsing operation, the supply of rinsing fluid is increased to a large value of 0.5 liter/min per wafer, and the semiconductor wafer is rinsed within a short time period of three minutes or less. As a result, the time during which aluminum reacts in the rinsing operation can be shortened, and sufficient substitution of the residual removal fluid can be effected.

> In the fourth embodiment, a sufficient effect can be yielded by carrying out solely the above-described operations. Through combination of the apparatus and methods described with reference to the first through third embodiments, a further improvement in resist residue removal characteristics can be expected. Muranaka 5:6 -5:20.

Muranaka at 4:65 - 5:17 describes "substitution of the residual removal fluid." In other words, rather than removing resist using the resist removal fluid of, for example, step (1) of Muranaka's first embodiment, resist is removed in the fourth embodiment by rinsing or washing with a fluid (e.g., ultrapure water, a fluid specifically designed for rinsing purpose, or a combination thereof). However, nothing in the cited sections of Muranaka teaches or fairly suggests "contacting the electrically conductive interconnect line with a solution to remove residual polymer after" Muranaka's rinsing method and/or a washing method for removing resist residue and is characterized in that a fluid used for rinsing or washing (e.g., ultrapure water, a fluid specifically designed for rinsing purpose, or a combination thereof), either alone or in combination with the remaining limitations of claim 1.

Muranaka states in 5:15 - 17, "In the fourth embodiment, a sufficient effect can be yielded by carrying out **solely** the above-described operations," i.e., rinsing or washing with a fluid (e.g., ultrapure water, a fluid specifically designed for rinsing purpose, or a combination thereof) maintained at a temperature of 20 degrees C or less. Murnaka's **sole** act of rinsing or washing with a fluid (e.g., ultrapure water, a fluid specifically designed for rinsing purpose, or a combination thereof) maintained at a temperature of 20 degrees C or less, without more, cannot anticipate claim 1 since claim 1 specifically requires **two** acts: (a) contacting the electrically conductive interconnect line with liquid water after formation of the electrically conductive interconnect line, and (b) contacting the electrically conductive interconnect line with a solution to remove residual polymer after the electrically conductive interconnect line is contacted with the liquid water.

Muranaka also states in 5:17-20, "Through combination of the apparatus and methods described with reference to the first through third embodiments, a further improvement in resist residue removal characteristics can be expected." Appellant has shown that none of Muranaka's first through third embodiments teach or fairly suggest the invention of claim 1. Muranaka's

suggestion of combining his first three embodiments amounts to a sixth embodiment of an unknown sequence of steps for removing residual resist. Claim 1 cannot be found anticipated based on an unknown sequence of steps for removing residual resist. See MPEP 2131. For these reasons, the fourth embodiment of Muranaka fails to teach or fairly suggest claim 1.

Muranaka's fifth embodiment is directed to a method which includes a draining step for the purpose of removing resist residue. Muranaka 5:23 - 25. After completion of the removal fluid processing step, the semiconductor is rotated at high speed before the washing step is commenced, thereby eliminating the removal fluid from the semiconductor wafer. Muranaka 5:25-29. The fifth embodiment of Muranaka fails to teach or fairly suggest claim 1's requirement of contacting the electrically conductive interconnect line with a solution to remove residual polymer **after** the electrically conductive interconnect line is contacted with the liquid.

35 U.S.C. § 103(a) Rejections

(1) Claim 27 stands rejected under 35 U.S.C § 103(a) as being unpatentable over Muranaka and Wang.

Independent claim 27, like independent claim 1, recites contacting the electrically conductive interconnect line with liquid water followed by contacting the electrically conductive interconnect line with a solution to remove residual polymer. The final office action asserts that Muranaka discloses all the limitations of independent claim 27 except for the liquid water having a pH slightly less than neutral. Appellant has shown above that the cited sections of Muranaka do not teach or fairly suggest independent claim 27's requirement of contacting the electrically conductive interconnect line with liquid water followed by contacting the electrically conductive interconnect line with a solution to remove residual polymer. The final office action does not allege this limitation is taught in Wang. As such, Appellant submits claim 27 is patentably distinguishable over the cited sections of Muranaka and Wang.

The Office Action admits that Muranaka lacks claim 27's requirement that the liquid water has a pH less than neutral. Thereafter, the Office Action asserts that Wang teaches the removal of polymer residues from an interconnect overlaying a tungsten plug using an electrolytic solution, which is either acidic or basic, in order to avoid corrosion of the overlying

interconnect, citing column 1, lines 49-62; column 3, lines 50-67; column 3, lines 1-9 of Wang in support thereof. Appellant disagrees.

Column 1, lines 49-62 of Wang recites the use of a ***neutral*** ionic solution such as deionized water to avoid the occurrence of tungsten corrosion. In column 3, lines 1-9, Wang discloses use of an *alkaline* electrolyte solution, the pH value of which is greater than 7.5. Appellant notes that Wang lacks column 3, lines 5-57. As such, the cited sections of Wang clearly do not teach or fairly suggest the use of an acidic (i.e., a pH less than neutral) solution to avoid corrosion of an overlying interconnect as asserted in the Office Action.

(2) All claims stand rejected under 35 U.S.C. § 103 as being unpatentable over Mautz in view Tsai and further in view of page two, paragraph nine, through page 3, paragraph 11 of the instant application.

The Office Action asserts that page 2, paragraph nine through page 3, paragraph 11 of the instant application is admitted prior art. Appellant disagrees.

MPEP 2129 describes three instances in which admissions of prior art can be made in an application or during the prosecution thereof. MPEP 2129 (I) states "a statement by an applicant during prosecution identifying the work of another as "prior art" is an admission that the work is available as prior art against the claims, regardless of whether the admitted prior art would otherwise qualify as prior art under the statutory categories of 35 U.S.C. § 102." At no point during prosecution has Appellant unconditionally admitted the Background of the instant application is prior art. Accordingly, the Background of the instant application cannot be viewed as admitted prior art under MPEP 2129(I).

MPEP 2129 (II) sets forth "where the specification identifies work done by another as 'prior art' the subject matter so identified is treated as admitted prior art." The instant application at no point indicates the Background section is identified as "prior art." Accordingly, the Background of the instant application cannot be deemed admitted prior art under MPEP 2129 (II).

MPEP 2129 (III) states "drafting a claim in Jepson format (i.e., the format described in 37 C.F.R. 1.75(e)); see MPEP § 608.01(m) is taken as an implied admission that the subject matter

of the preamble is the prior art work of another." Appellant has not presented claims in Jepson format. Accordingly, the Background of the instant application cannot be considered admitted prior art under MPEP 2129 (III).

MPEP 608.01(c) states the Background of the Invention ordinarily includes (1) Field of Invention, and (2) Description of the related art including information disclosed under 37 C.F.R. § 1.97 and 37 C.F.R. 1.98: A paragraph describing to the extent practicable the state of the prior art or other information disclosed known to the applicant, including references to specific prior art or other information where appropriate where applicable, the problems involved in the prior art or other information disclosed which are solved by the Appellant's invention should being indicated. Appellant asserts that MPEP 608.01(c) does not require the Examiner's assertion that the Background of the instant application constitutes prior art since MPEP 608.01(c) does not require a description of the state of the prior art. Rather, this section of the MPEP states that the state of the prior art should be included in the Background section to the extent practical. Moreover, MPEP 608.01(c) (2) states that "where applicable, the problems involved in the prior art should be indicted in the background of the invention. Again, it is not mandatory that problems involved in the prior art should be indicated in the Background of the invention. Accordingly, Appellant asserts that it is error for the Examiner to presume the Background of the instant application is admitted prior art.

Even if page 2, paragraph nine through page 3, paragraph 11 of the instant application is admitted prior art, claims 1, 27, and 32 are patentably distinguishable over Mautz in view of Tsai and further in view of the admitted prior art. Each of independent claims 1, 27, and 32 recite "wherein the electrically conductive interconnect line is contacted with the liquid water for less than 120 minutes." In rejecting all claims as being unpatentable over Mautz in view of Tsai, the Office Action asserts on page 6 that Mautz teaches "wherein the electrically conductive interconnect line is contacted with the liquid water for less than 120 minutes" citing Mautz claim 1; 4:2-27, 5:30-35, 6:2-4, 6:28-29, 6:45-61, 7:2-17 in support thereof. Appellant has reviewed these cited sections of Mautz and can find no teaching or fair suggestion of the independent claims' limitation "wherein the electrically conductive interconnect line is contacted with the liquid water for less than 120 minutes" either alone or in combination with the other limitations

of the independent claims. One of these cited sections does teach "solvent rinse time," but solvent rinse time is different than water rinse time. See Mautz 6:45-47.

The limitation "wherein the electrically conductive interconnect line is contacted with the liquid water for less than 120 minutes" is time specific. While Mautz may teach contacting the electrically conductive interconnect line with liquid water after formation of the electrically conductive line, Mautz is silent about the amount of time his electrically conductive interconnect line is contacted with liquid water. As such, claims 1, 27 and 32 are patentably distinguishable over the cited sections of Mautz and Tsai.

In addition to the foregoing, Appellant asserts that Mautz teaches away from combination with Tsai along the lines set forth in the Final Office Action. A prior art reference that "teaches a way" from the claimed invention is a significant factor to be considered in determining obviousness. It is improper to combine references where the references teach away from their combination. *In re Grasselli*, 713 F.2d 731, 743 (Fed. Cir. 1983) (The claimed catalyst which contained both iron and an alkaline metal was not suggested by the combination of a reference which taught the interchangeability of antimony and alkali metal with the same beneficial result, combined with the reference expressly excluding antimony from, and adding iron to, a catalyst). MPEP 2145.

The Examiner asserts that Mautz teaches all the limitations of independent claim 1 except for "contacting the electrically conductive interconnect line with ***a solution to remove residual polymer*** after the electrically conductive interconnect line is contacted with the liquid water." The Examiner then asserts that Tsai teaches this missing limitation. More specifically, the Examiner asserts that Tsai teaches photoresist removal by ashing, which often leaves a polymer residue on the surface of the wafer to be subsequently be removed by **a wet stripper (i.e., a solvent, alkaline, etc.)** citing column 1, lines 34-60 of Tsai in support thereof. The Examiner asserts that it would have been obvious to one of ordinary skill in the art to have incorporated in the method of Mautz, a solution contacting the electrically connective interconnect line to remove residual polymer, as taught in the method of Tsai.

Appellant asserts that it is improper to combine Mautz and Tsai along the lines suggested in the Final Office Action. The abstract of Mautz teaches a middle etching processing sequence which eliminates the need to use an organic masking layer solvent. Mautz makes clear that it is undesirable to use a solvent to remove photoresist. Mautz teaches in column 1, lines 12-62:

> Interconnects allow various parts of a semiconductor device to be electrically connected with other parts of the semiconductor device. ***Unfortunately, the processes that form interconnects typically introduce mobile ions that degrade device reliability. Mobile ions, such as sodium, lithium, potassium, calcium, and magnesium, typically come from two sources: during a metal etching step and from an organic solvent typically used in removing a photoresist masking layer.*** The conventional wisdom of those skilled in the art is that mobile ions introduced during the metal etching steps lie only on exposed surfaces of an insulating layer or an interconnect formed during the metal etching process. A quick deionized water rinse after photoresist removal should remove virtually all of the mobile ions if they lie on exposed surfaces. Semiconductor devices that only have a deionized water rinse after photoresist removal still have unacceptably high device reliability problems.
>
> Organic masking layer solvents include mobile ions. As used in this specification, an organic masking layer solvent is a chemical that is capable of readily removing an organic making layer (i.e., photoresist, etc.). Examples of organic masking layer solvents include ketones (2-propanone) (acetone), etc.) aliphatic hydrocarbons (n-heptane, etc.) alkali-amines (tetramethyl ammonium hydroxide, etc.), and aryl hydrocarbons (tolune, phenol, etc.). Examples of chemicals that are not organic masking layer solvents include alcohols (methanol, ethanol, 2-propanol (isopropyl alcohol), or the like) and glycols (methanediol (methylene glycol), 1,2-ethanediol (ethylene glycol), 1,2-propanediol (propylene glycol), or the like). These latter chemicals typically have at least one hydroxyl group for no more than ten carbon atoms within the molecule, wherein that hydroxyl group is directly attached to a carbon atom other than a carbon atom that is part of an aryl radical (i.e., not phenol). Although the alcohols and/or glycols may attack an organic masking layer, the rate of removing the organic masking layer typically is slow enough that it does not

> make the alcohols and/or glycols a chemical that readily removes an organic masking layer.
>
> ***Many photoresist removal processes after a metal etching step use an organic masking layer solvent by itself or an aggregation of plasma ashing and an organic masking layer solvent. Many commercially-available organic solvents have mobile ions concentrations that are measured in parts per million. High-purity solvents are available that have mobile ions concentrations as low as about 10 parts per billion. However, these high purity organic solutions may still add mobile ion contamination to semiconductor devices. The cost of the organic solvents increase dramatically with higher purity.***

Mautz then teaches in column 5, lines 23-29:

> After the plasma metal etching step, the photoresist members 421 and 422 may be removed using at least one conventional plasma ashing technique. The photoresist members 421 and 422 are substantially removed by the plasma ashing step. ***The photoresist member 421 and 422 are not removed in whole or in part by organic masking layer solvents.***

Even though Tsai may teach removing residual polymer on the surface of the wafer using a wet stripper (i.e., a solvent, alkaline, etc.) in column 1, lines 34-60 as noted by the Examiner, Mautz teaches that the wet stripper (solvent) should not be used in his process.

Clearly, Mautz teaches away from using the solvent of Tsai in his process to remove photoresist because of the introduction of mobile ion contamination and other reasons. Accordingly, Mautz should not be combined with Tsai along the lines suggested by the Final Office Action to render claims 1-9 unpatentable under 35 U.S.C. § 103.

CONCLUSION

For the above reasons, Appellant respectfully submits that the rejection of pending Claims 1-9 and 27-37 is unfounded. Accordingly, Appellant respectfully requests that the Board reverse the rejections of these claims.

I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class Mail in an envelope addressed to: Mail Stop Appeal Brief-Patent, Commissioner for Patents, P. O. Box 1450, Alexandria, Virginia, 22313-1450, on October 23, 2006.

Attorney for Appellant — Date of Signature: 10/23/06

Respectfully submitted,

Eric A. Stephenson
Attorney for Appellant
Reg. No. 42,324
Telephone: (512) 439-5097
Facsimile: (512) 439-5099

CLAIMS APPENDIX

1. (Previously Presented) A method comprising:

forming a tungsten plug in a dielectric layer;

forming an electrically conductive interconnect line on the dielectric layer after formation of the tungsten plug, wherein the tungsten plug is electrically connected to the electrically conductive interconnect line;

contacting the electrically conductive interconnect line with liquid water after formation of the electrically conductive interconnect line;

contacting the electrically conductive interconnect line with a solution to remove residual polymer after the electrically conductive interconnect line is contacted with the liquid water;

wherein the electrically conductive interconnect line is contacted with the liquid water for less than 120 minutes.

2. (Previously Presented) The method of claim 1 wherein the liquid water is degasified and deionized.

3. (Previously Presented) The method of claim 1 wherein the liquid water is deionized but not degasified.

4. (Previously Presented) The method of claim 1 wherein the liquid water is degasified but not deionized.

5. (Previously Presented) The method of claim 1 wherein the liquid water is neither degasified nor deionized.

6. (Previously Presented) The method of claim 1 wherein the liquid water has a pH that is at or near neutral.

7. (Previously Presented) The method of claim 1 wherein the electrically conductive interconnect line is contacted with the liquid water for less than 60 minutes.

8. (Previously Presented) The method of claim 1 wherein the electrically conductive interconnect line is contacted with the liquid water for less than 15 minutes.

9. (Previously Presented) The method of claim 1 wherein the electrically conductive interconnect line is formed from a metal stack that includes one or more of titanium, titanium nitride, aluminum, an aluminum copper alloy, and an aluminum silicon copper alloy.

10. - 26. (Canceled)

27. (Previously Presented) A method comprising:

forming a tungsten plug in a dielectric layer;

forming an electrically conductive interconnect line on the dielectric layer after formation of the tungsten plug, wherein the tungsten plug is electrically connected to the electrically conductive interconnect line;

contacting the electrically conductive interconnect line with liquid water having a pH slightly less than neutral after formation of the electrically conductive interconnect line;

contacting the electrically conductive interconnect line with a solution to remove residual polymer after the electrically conductive interconnect line is contacted with the liquid water;

wherein the electrically conductive interconnect line is contacted with the liquid water for less than 120 minutes.

28. (Previously Presented) The method of claim 27 wherein the liquid water is degasified and deionized.

29. (Previously Presented) The method of claim 27 wherein the liquid water is deionized but not degasified.

30. (Previously Presented) The method of claim 27 wherein the liquid water is degasified but not deionized.

31. (Previously Presented) The method of claim 27 wherein the liquid water is neither degasified nor deionized.

32. (Previously Presented) A method comprising:

forming a tungsten plug in a dielectric layer;

forming an electrically conductive interconnect line on the dielectric layer after formation of the tungsten plug, wherein the tungsten plug is electrically connected to the electrically conductive interconnect line;

contacting the electrically conductive interconnect line with liquid water after formation of the electrically conductive interconnect line;

contacting the electrically conductive interconnect line with a solution to remove residual polymer on the electrically conductive interconnect line after the electrically conductive interconnect line is contacted with the liquid water;

wherein the electrically conductive interconnect line is contacted with the liquid water for less than 120 minutes.

33. (Previously Presented) The method of claim 32 wherein the liquid water is degasified and deionized.

34. (Previously Presented) The method of claim 32 wherein the liquid water is deionized but not degasified.

35. (Previously Presented) The method of claim 32 wherein the liquid water is degasified but not deionized.

36. (Previously Presented) The method of claim 32 wherein the liquid water is neither degasified nor deionized.

37. (Previously Presented) The method of claim 32 wherein the liquid water has a pH that is at or near neutral.

EVIDENCE APPENDIX

None.

RELATED PROCEEDINGS APPENDIX

None.